

INTRODUCTION TO CLOSED CIRCUIT TELEVISION

Presented By: Kristina Irelan and John Ehlers

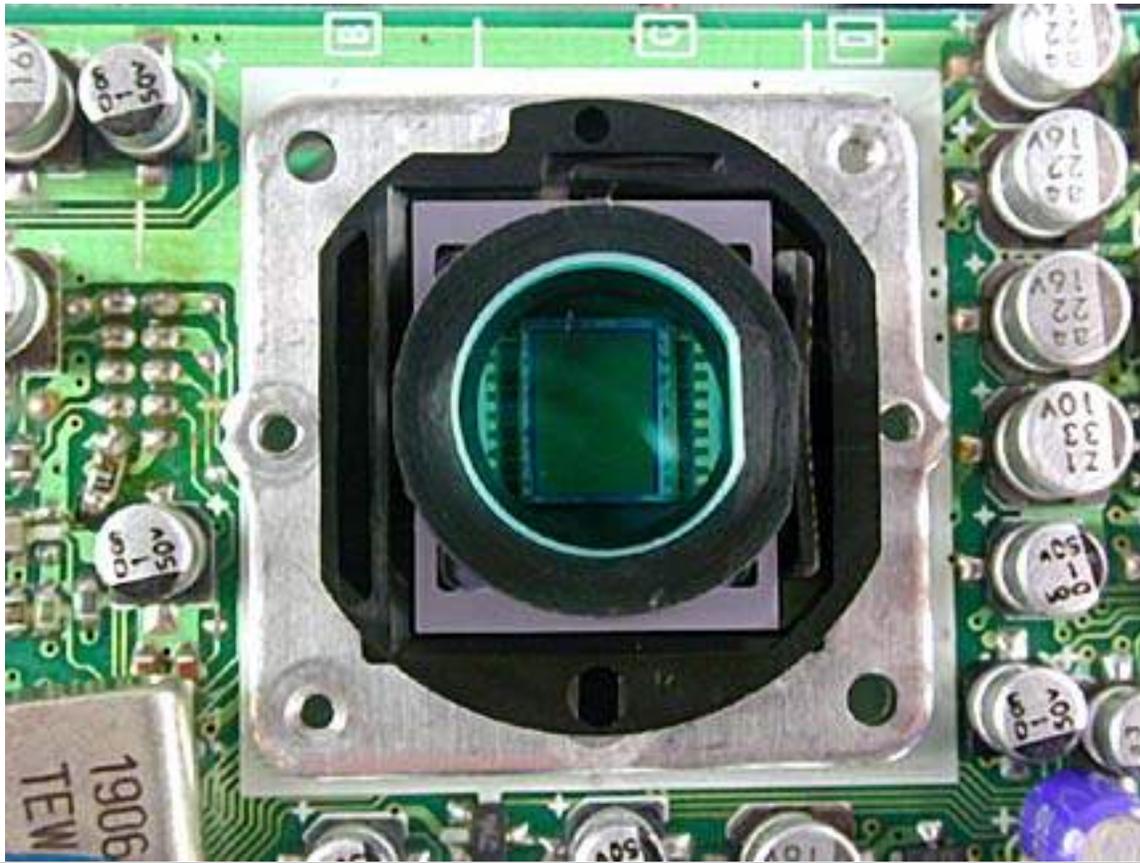
TABLE OF CONTENTS:

- 3 How Cameras Work**
- 4 CCTV Identification**
- 8 Laptop and Monitor Connections**
- 14 Equipment used in the NW Region**
- 21 Equipment used in the Oly Region**
- 24 Communication w/ the Camera**
- 26 Camera Movements**
- 28 Wire Terminations**
- 31 Switches**
- 34 Internet Protocol**
- 36 Types of Video Systems**
- 44 Troubleshooting**
- 46 Preventative Maintenance**
- 47 Wiring Schematics**
- 52 One Line Diagrams**
- 54 CCTV ITS Drawings**
- 57 Citations**

How a camera works:

At its most basic level, a camera has a series of [lenses](#) that focus light to create an image of a scene. But instead of focusing light onto a piece of film, video is focused onto a Charge Coupled Device that records light electronically. The semiconductor device (CCD) measures [light](#) with a half-inch panel of 300,000 to 500,000 tiny light-sensitive diodes called photosites. Each photosite measures the amount of light (photons) that hits a particular point, and translates this information into electrical charges. A brighter image is represented by a higher electrical [charge](#), and a darker image is represented by a lower electrical charge. But measuring light intensity only gives us a black-and-white image. To create a color image the CCD has to detect not only the total light levels, but also the levels of each [color](#) of light. Since you can produce the full spectrum of colors by combining the three colors red, yellow and blue, the CCD only needs to measure the levels of these three colors to be able to reproduce a full-color picture.

CCD



Closed Circuit Television Identification:**COHU 8200 MPCD**

MPCD- Long camera lens.

Inside the Cabinet- large white control box with cannon plugs protruding from the base of it.

Or- rack mounted MPCD box. (Has a power switch and a green LED on the front.)



COHU 3955 iVIEW

Lens attached to housing on top Inside the cabinet: a bi-directional transmitter or receiver with a plastic connector with 5 wires coming from the camera cable will be connected to it.



COHU 3965 iVIEW

Housing on side-series (Looks like R2D2). Inside the cabinet: a bi-directional transmitter or receiver with a plastic connector with 5 wires coming from the camera cable will be connected to it.



COHU 3925 iDOME

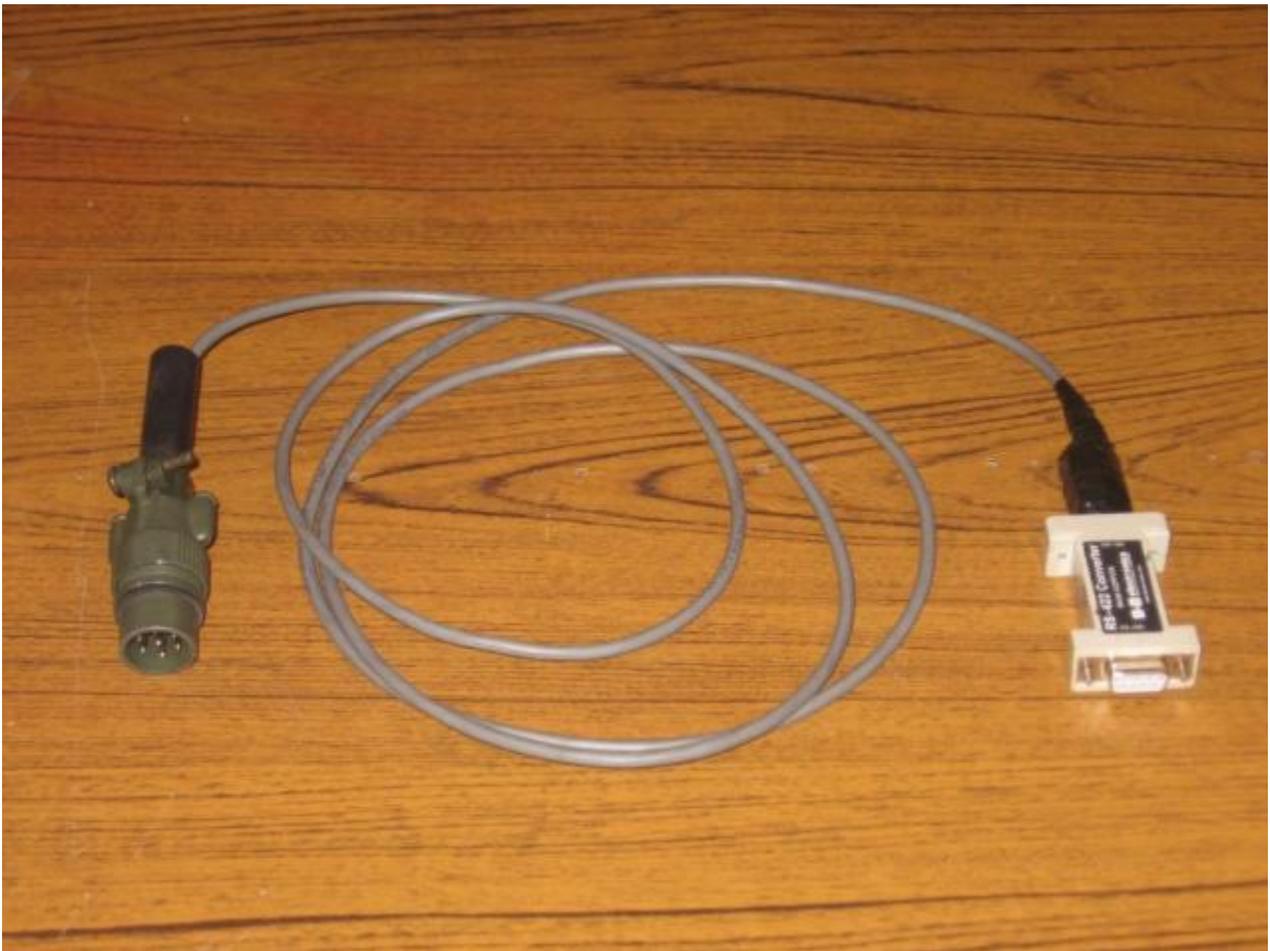
Lens is a half sphere on the bottom. Inside the cabinet: a bi-directional transmitter or receiver with a plastic connector connected to the control cable coming from the camera.



LAPTOP AND MONITOR CONNECTIONS:

MPC-D Wall Mount: use the cable that has a 7 pin cannon plug on one end and a RS-422 converter on the other. Remove the cannon plug labeled "INPUT". Attach the cannon plug on the pigtail to the white control box and the RS-422 converter to your laptop.

RS-422 Connector uses: TD(A) Blk TD(B) Red RD(A) Grn RD(B) Wht

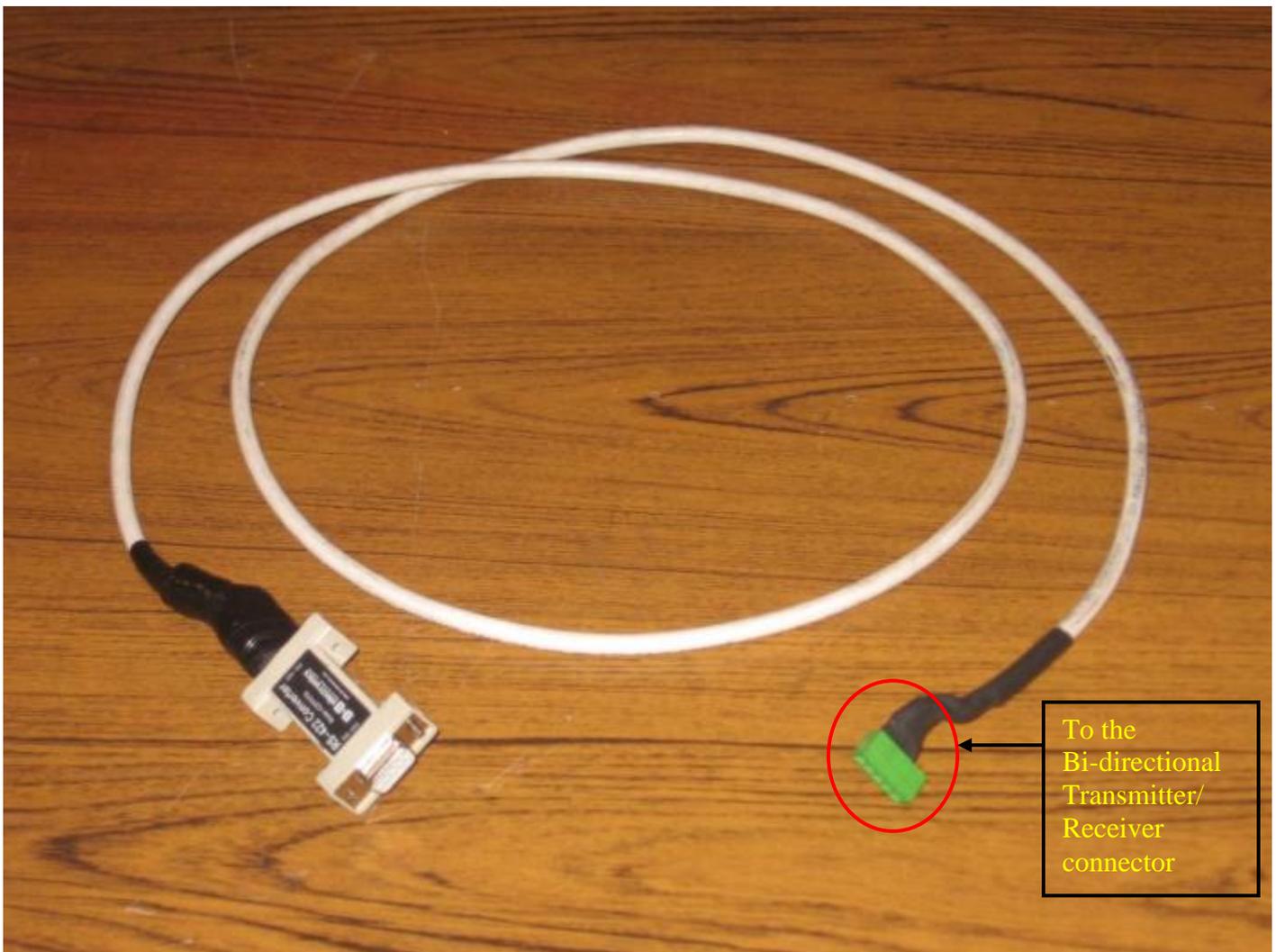
COMM CABLE FOR MPC-D Wall Mount

COMM CABLE FOR MPC-D Rack Mount



iVIEW and iDOME- use a cable that has a female plastic connector on one end and an RS-422 converter on the other. Remove the connector from the transmitter/receiver and plug it into the male plastic connector on the pigtail and the RS-422 converter to your laptop.

NW REGION iVIEW / iDOME



OLYMPIC REGION iVIEW CABLE



COAX- Remove the coax cable from the video feed interface and connect your coax pigtail to the cable. Connect the other side to your monitor or video card.

COAX CABLE



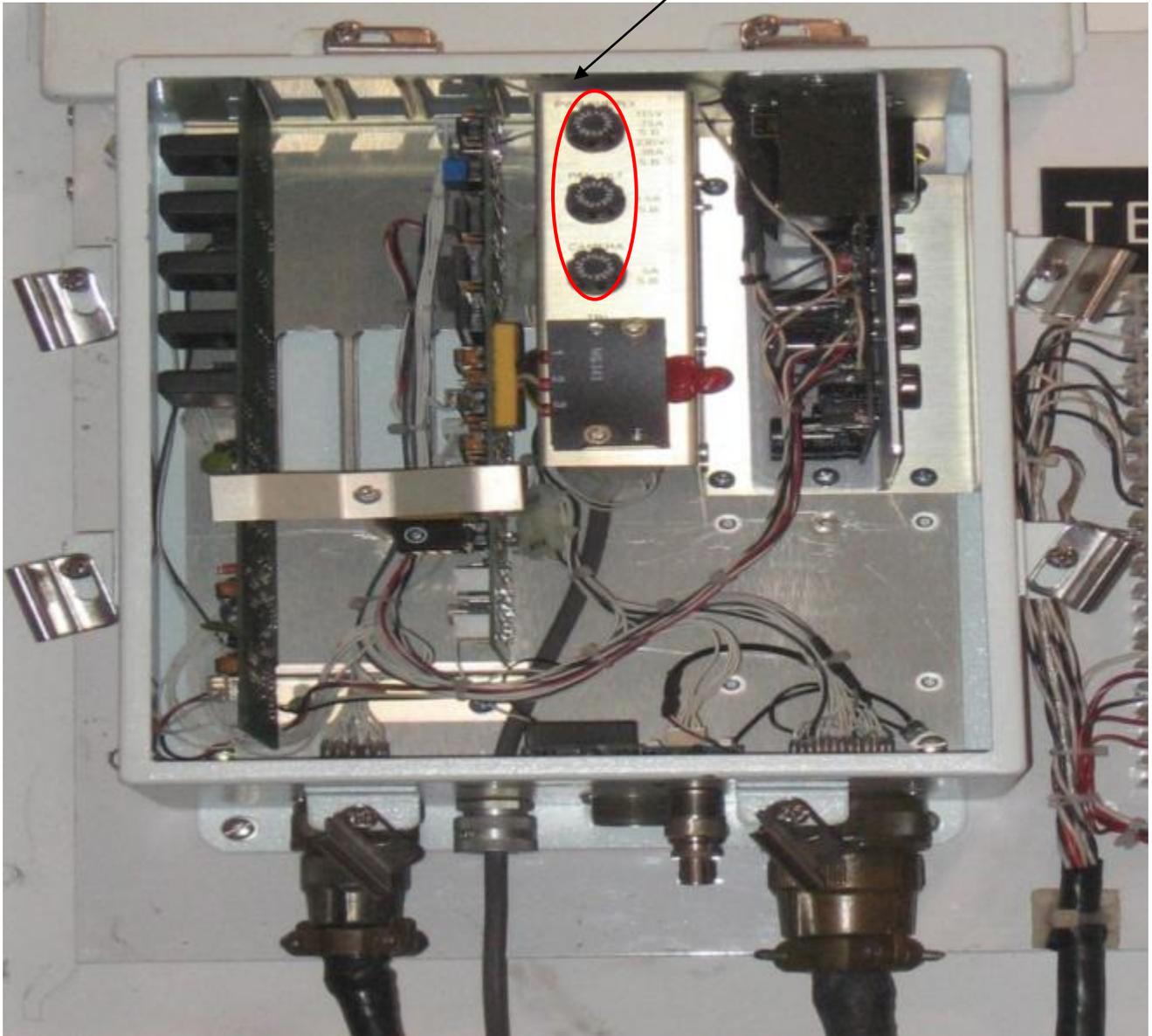
VIDEO TUNER CARD

The coax cable plugs into the yellow connector from the tuner card. This allows you to view the video from the camera on your laptop. A portable monitor can be used instead of a video tuner card and laptop combination.

EQUIPMENT USED IN THE NW REGION

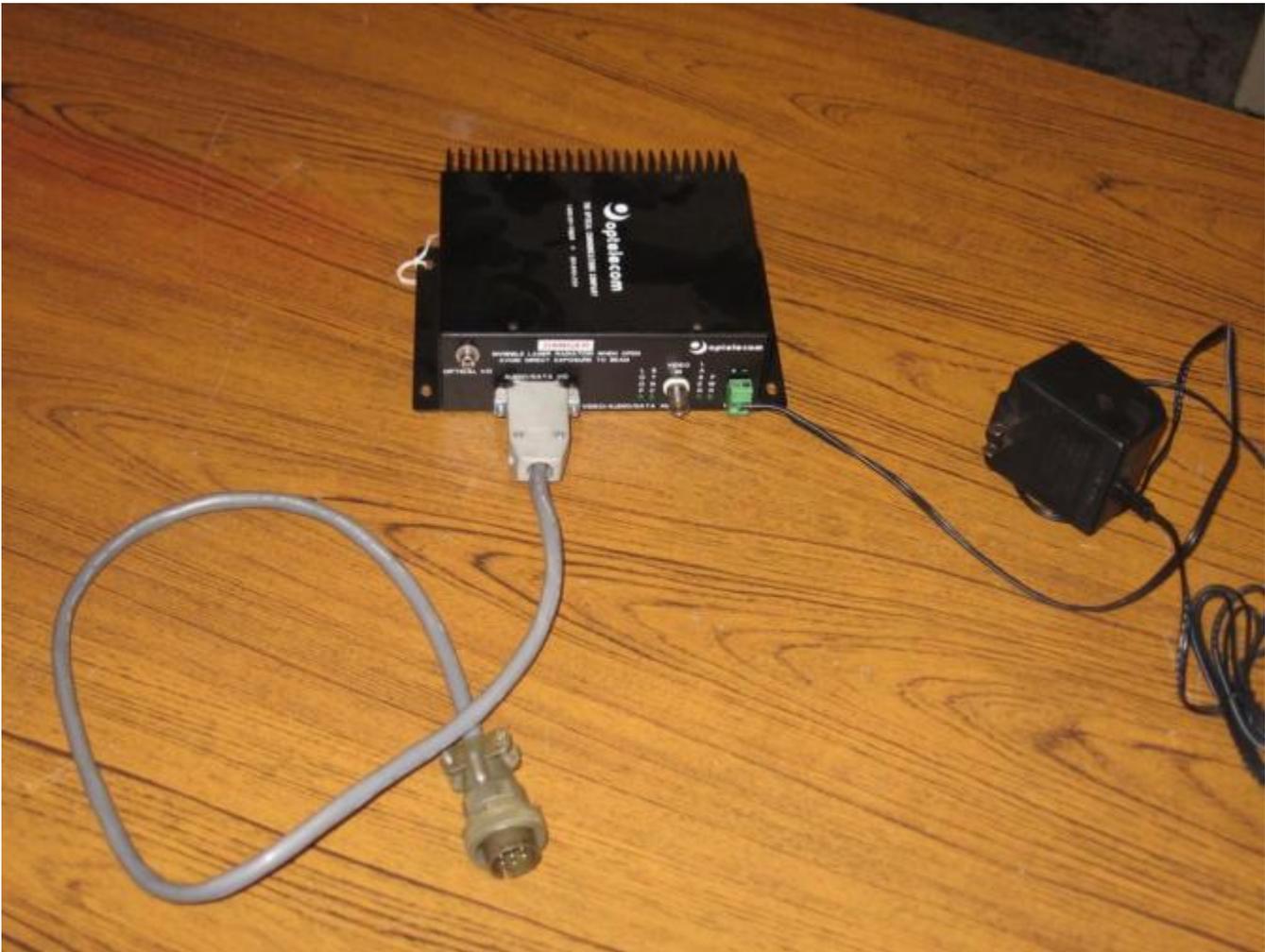
MPC-D-111 RECEIVER

Fuses



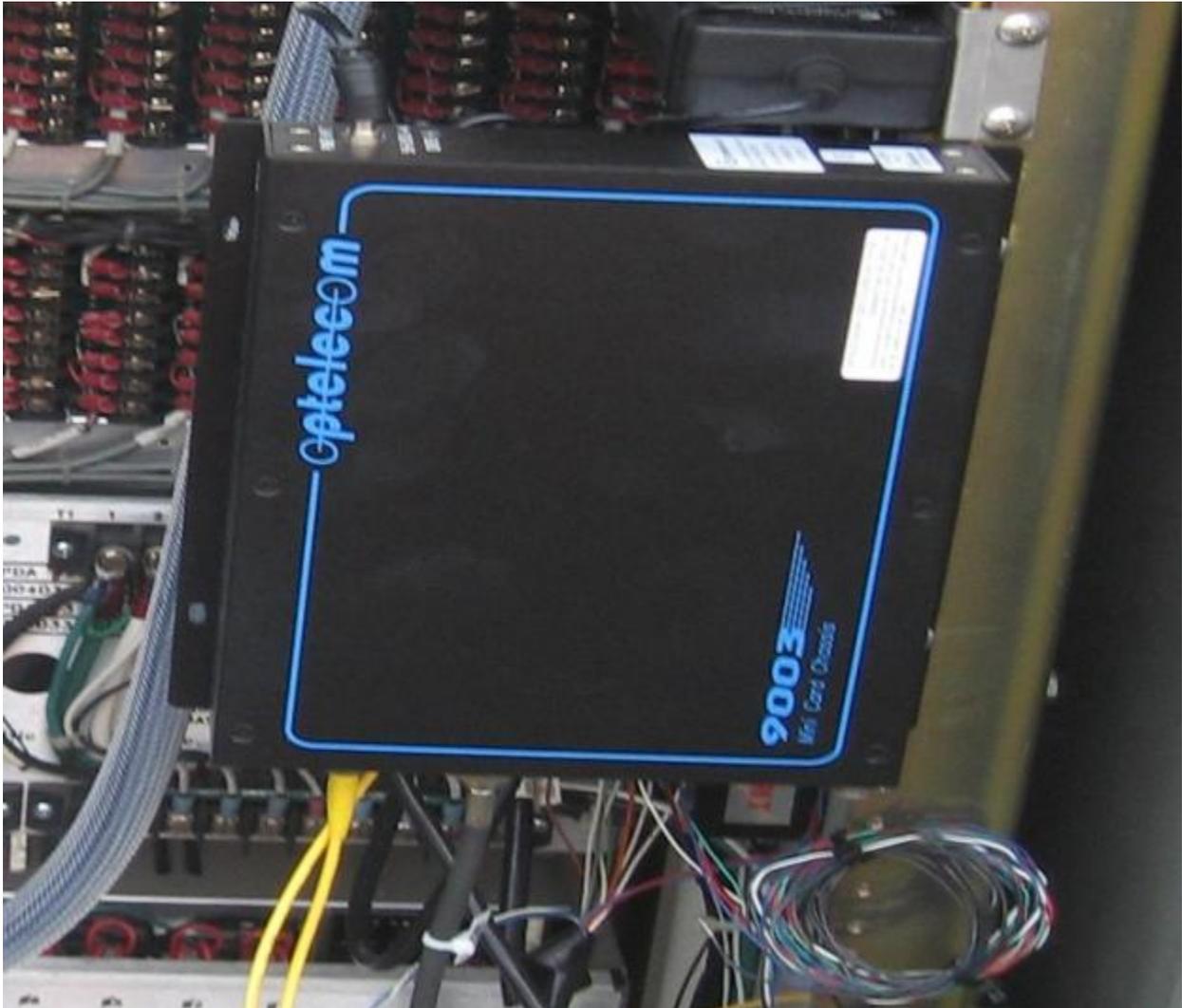
MPC-D-111 RECEIVER BOTTOM**MPC-D Receivers**

The terminations for the pan, tilt cable and the lens movement (zoom) cable are located on wiring diagrams located at the end of this manual.

OPTELECOM 3710 A/T Fiber Optic Video/Audio/Data Transmitter**OPTELECOM 3710 A/T Video/Audio/Data Transmitter**

This receiver works in conjunction with the MPC-D-111. The DB9 connector plugs into the 3710 transmitter. While the cannon plug on the other end of the factory pigtail is placed on the INPUT cannon plug located on the underside of the MPC-D receiver. The video cable plugs into the 3710 transmitter.

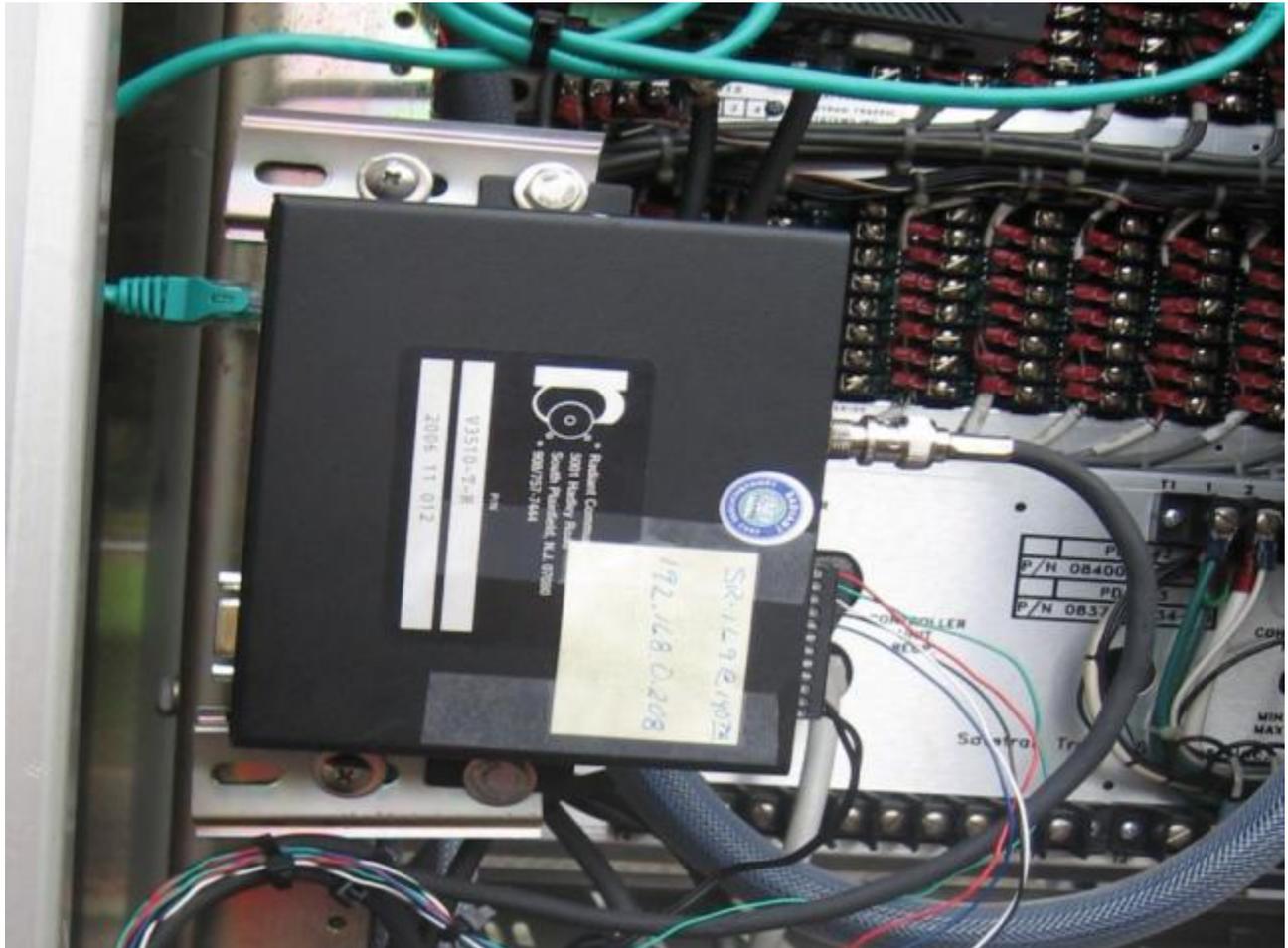
OPTELECOM 9221 Fiber Optic Receiver with Bi-Directional Data



Radiant Communications V3510-T-R Transmitter Mpeg Encoder



Side View of V3510-T-R Transmitter Mpeg Encoder

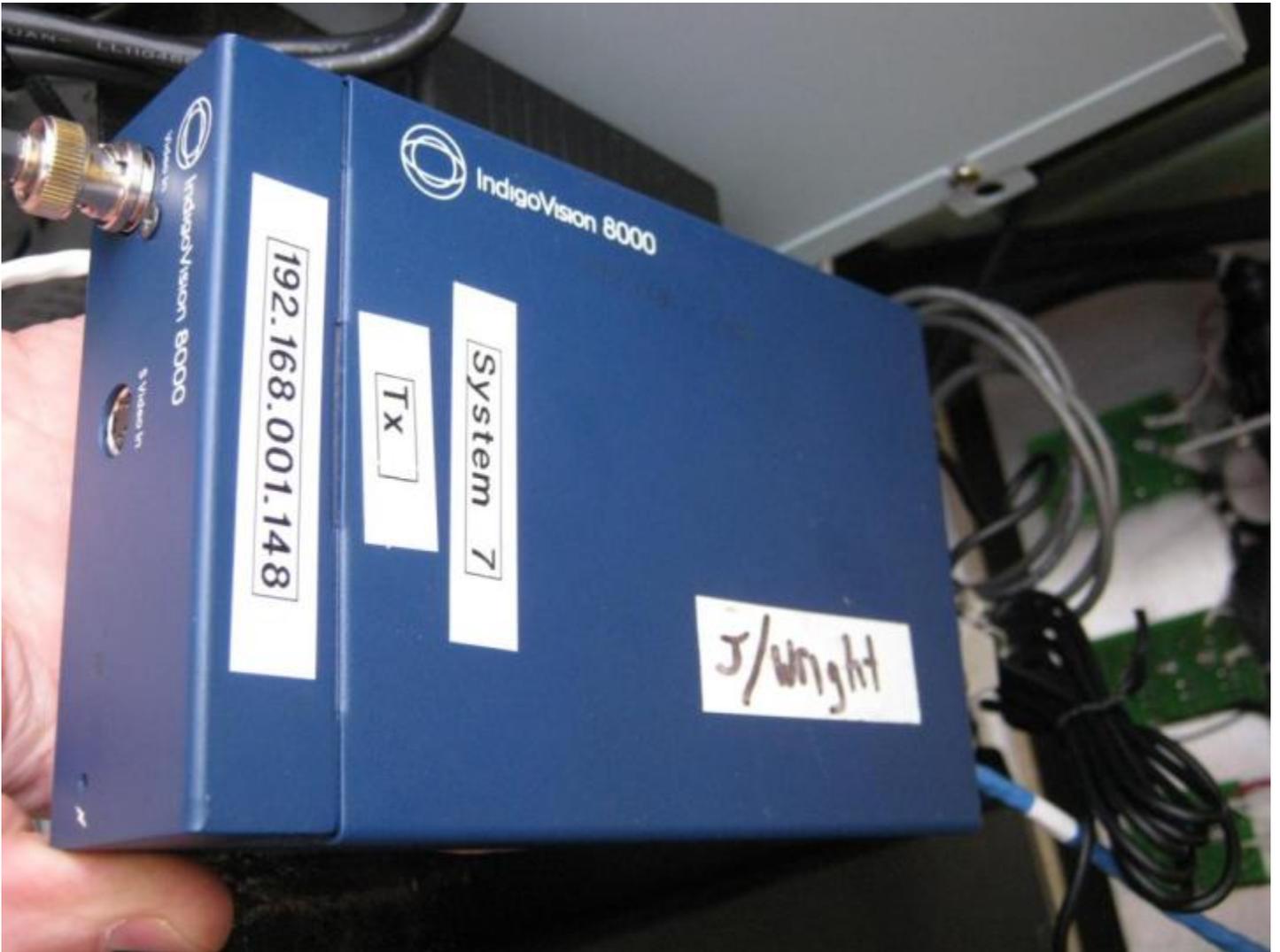


EQUIPMENT FOUND IN THE OLYMPIC REGION

International Fiber Systems (IFS) VT 4930WDM Video Transmitter and Data Transceiver



Side View of Indigo Vision 8000 Video Encoder

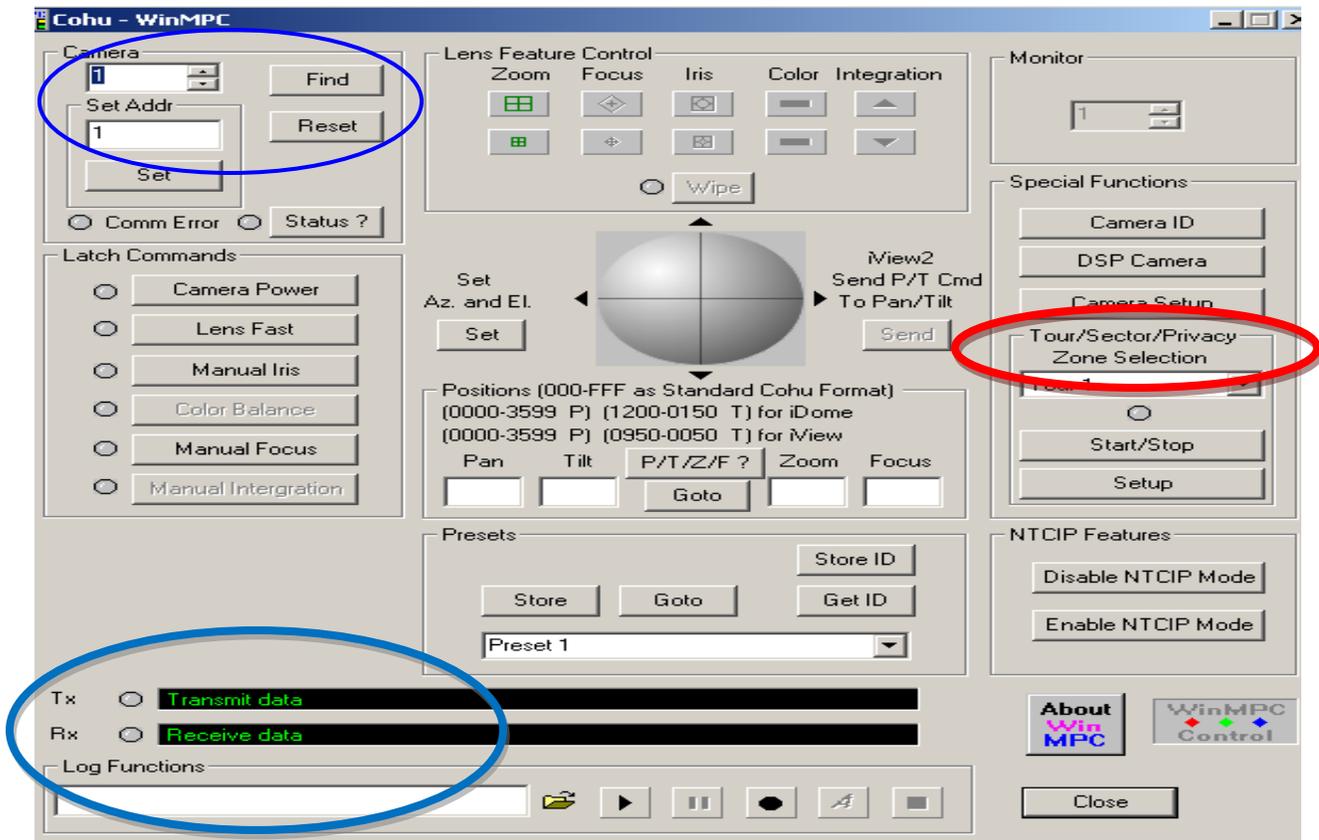


COMMUNICATION w/ the CAMERA:

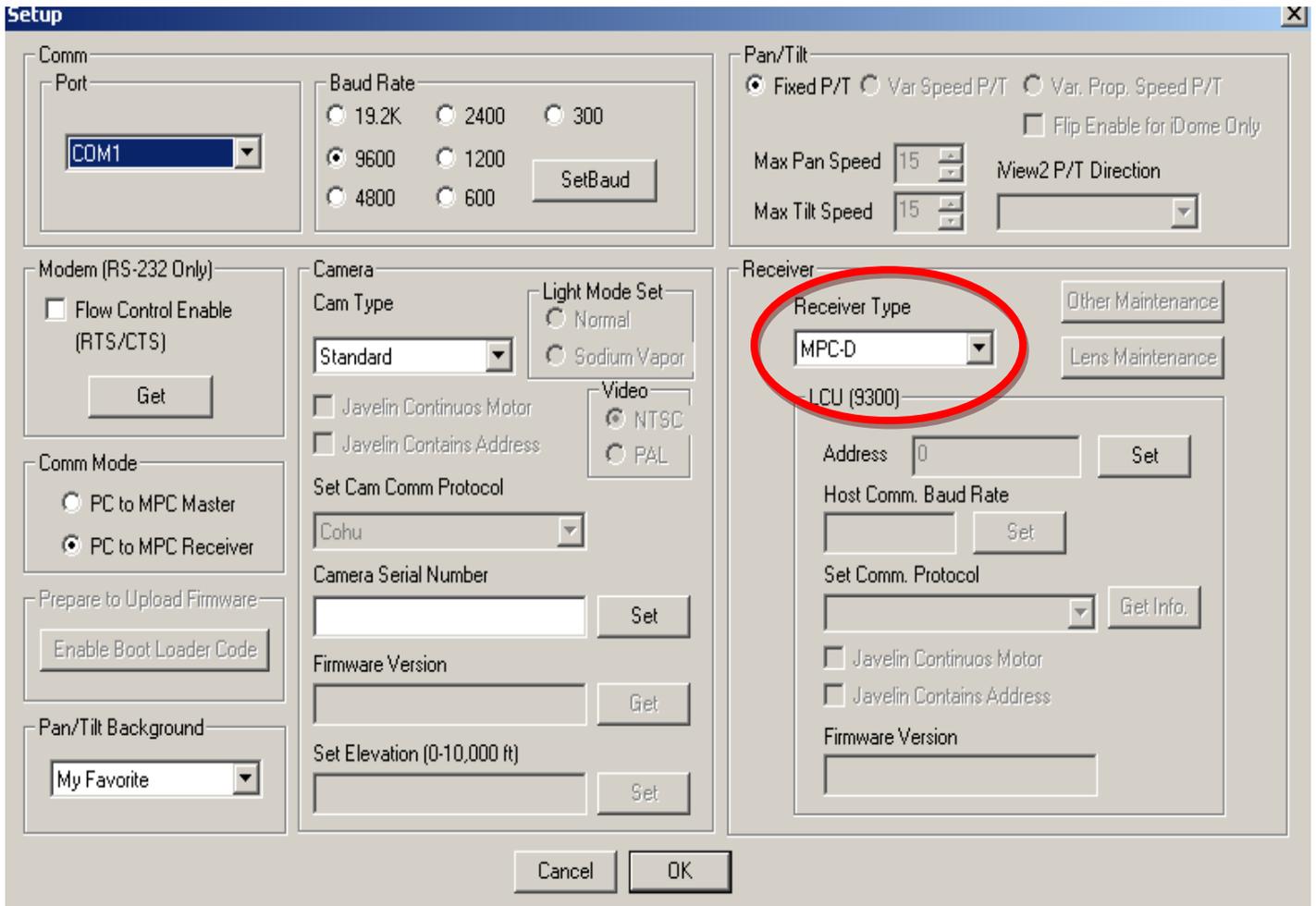
NOTE: The software running program that we use is called WINMPC. It can be downloaded onto a laptop from the COHU website at www.cohu-cameras.com/tech/techndx.html.

Once you download the software, click on the WINMPC icon. A screen will appear containing lens feature control icons, **latch commands** (power, lens fast, auto iris, etc.), special functions, and a box labeled camera with the number 1 within it. Finding the Camera: Ascertain the DROPP ADDRESS of the camera from the **SIMMS Tree** or circuit list. Place this number in the box labeled CAMERA. This box is located on the left side of your screen. Then click **Camera Set-Up**. Go to the RECEIVER TYPE box and select MPC-D. At the bottom of the set-up page, click OK. This should establish communications with the camera. If it doesn't work, click FIND (located next to the drop address). At this time the laptop will be trying to **communicate** with the camera. At the bottom of the screen you will see two boxes. One is the TX (transmit) and the other is RX (receive). When the laptop and the camera are communicating, the TX and RX boxes will contain **data information**. Then, a small box will appear stating that communication with the camera has occurred. Click O.K.

FINDING THE CAMERA



.CHOOSING THE TRANSMITTER/RECEIVER TYPE

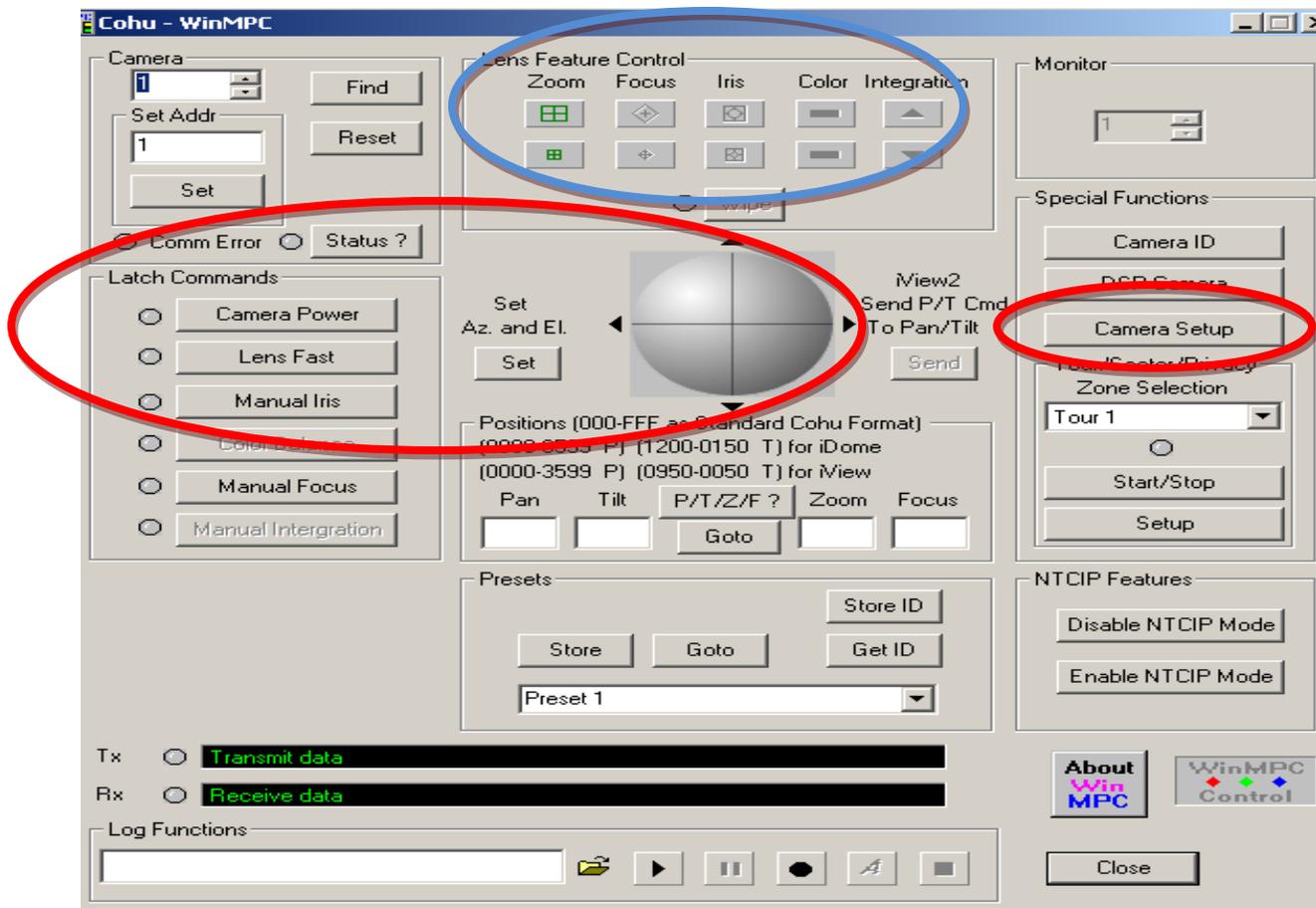


CAMERA MOVEMENTS:

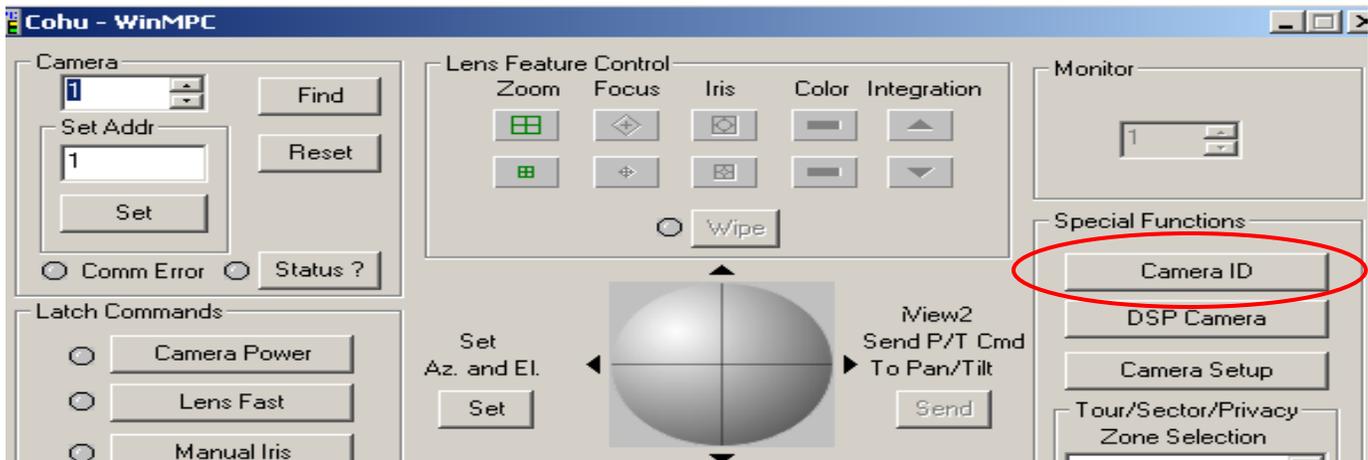
Once the camera has been found, you can move it ([pan/tilt](#)) and zoom, via the laptop operating program

MPCD: For the MPCD type camera, latch commands 'camera power' and 'lens fast' will be [enabled](#) (red dot next to the command). Then, use the sphere (it is broken into 4 quadrants) to move the camera.

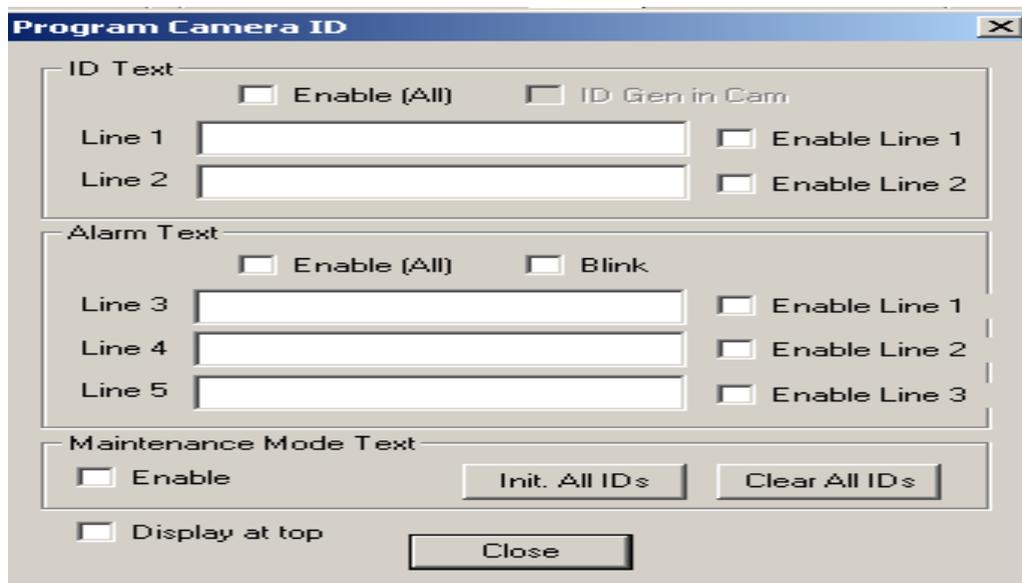
iVIEW and iDome: For these types of cameras, you will need to change the type of [receiver](#) software that you are using. Click on 'camera setup'. Then, on the right side of the screen, you will see a box labeled 'receiver'. Within this box is a drop table that allows you to change the receiver type. Change the receiver type from [MPCD](#) to iDome/iView. Then click O.K. at the bottom of the screen to enable this new running program. This program works only with the 3925/3955/3965 styles of cameras. This should allow you to move the camera (pan/tilt) and zoom.



CAMERA I.D. (label): To set the camera I.D. click on the ‘Camera I.D.’ command located on the right side of the screen.



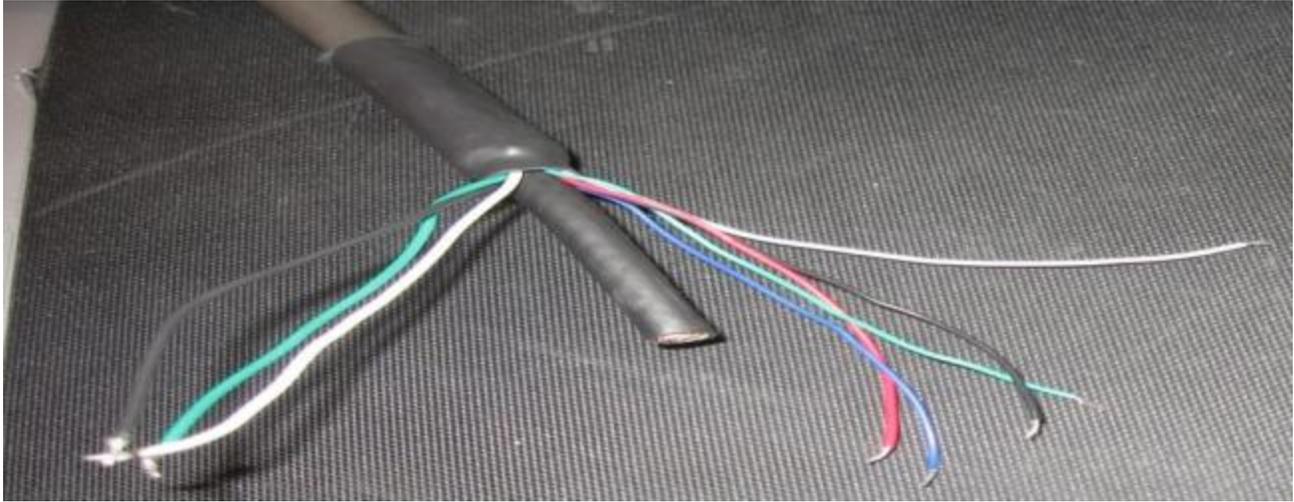
Using the SIMMS Tree for the correct label of the camera, type that name (in caps) into the Boxes labeled ‘Line 1’ and ‘Line 2’. Then click ‘Enable (All)’ and click Close. The text should be displayed on the top left of the screen when you look at the video feed from the camera.



COHU CABLES AND TERMINATIONS

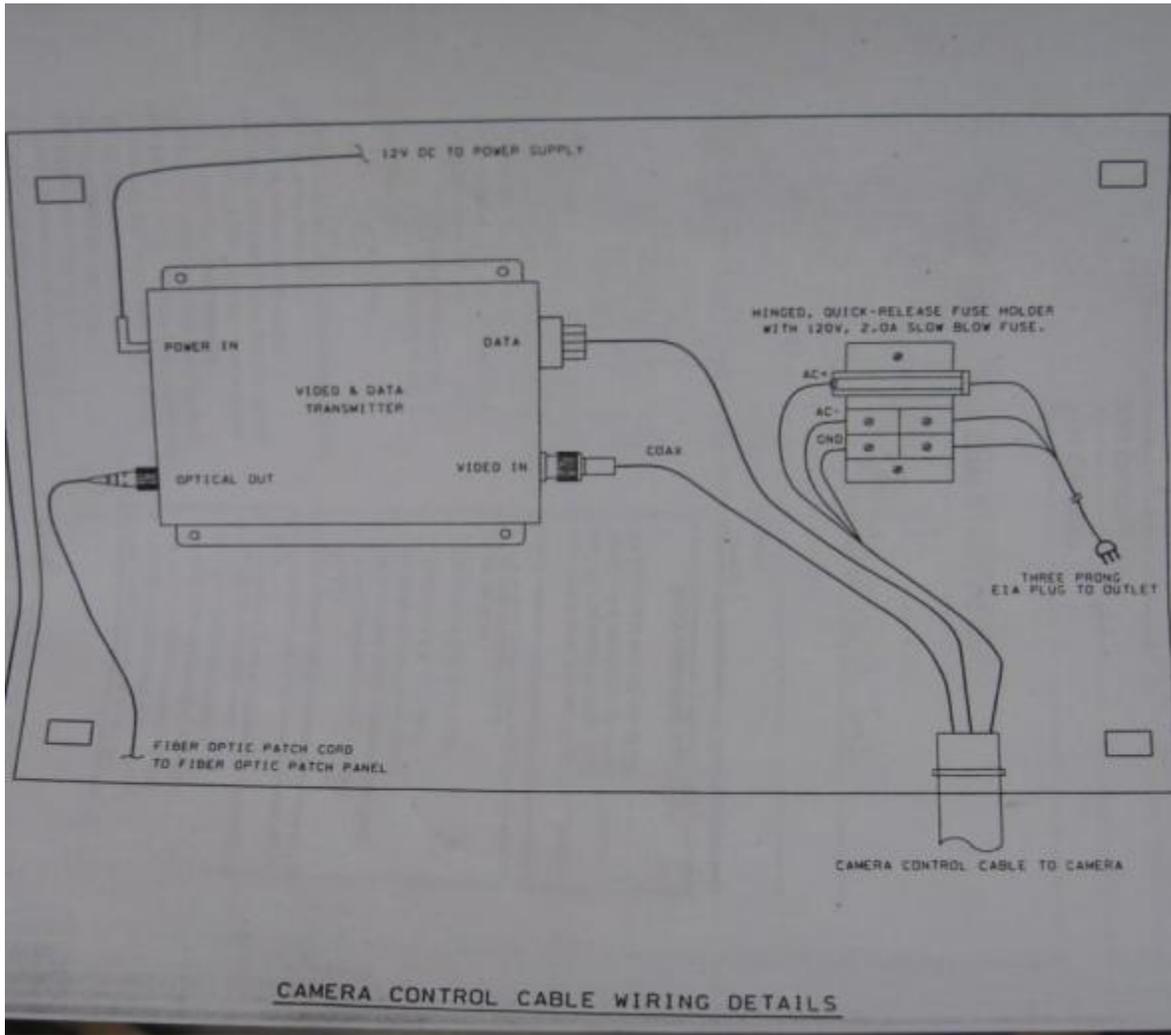
Terminated Cohu Cable AC27E



Cohu Cable CA295E**TERMINATING THE CA295E CABLE**

Using Cohu Cable CA295E cut the plastic casing and the mesh wiring from the cable. Inside will be a bundle of wires. The twisted green/red with black/white plus the blue make up the **wiring for a BNC connector =RED + GRN- = IN, WHT + BLK - = OUT, BLU = GRND.** The coax is a size **RG-59** using a style # 31-71008-1RFX connector made by Amphenol. The larger gage green, black, and white wires are used for the power. The rest of the wires are cut off and shrink tube is placed over them. The BNC connector plugs into the receiver/transmitter. The Fiber Optic pigtail is plugged into the side or bottom of the receiver/transmitter. The other end is then plugged into the Fiber Optic patch panel. **RG 59 = 31-71008-1RFX, RG 66 = 31-71032, RG 22 = 31-71008 RFX.**

CAMERA CONTROL CABLE DIAGRAM



SWITCHES

Rugged Comm RS900L 'Switch' Bi-Directional Fiber Optic to Ethernet



Rugged Comm RMC 40 'switch' Bi-Directional Fiber Optic to Ethernet



SMC Tiger Switch 6708L2 Ethernet Switch



Etherwan Switch



Internet Protocol (IP) addressing for Communicating with Computers, Switches, Bi-directional Receivers, Encoders, Axis Video Servers, etc.

An IP Address is a Numerical I.D. for a computer or a device that communicates via a network. A Sub-net Mask tells your computer or device which I.P. addresses are local to your network and where to send information. Changing the IP address and sub-net mask of your computer allows you to communicate with the device that you want to configure; like a switch. When a switch is new, it comes with the factory settings. In order for it to communicate on our network, we have to re-configure its IP address and Sub-Net Mask to ones that are suitable to our network. In order to do this, we must first (temporarily) modify our computer's network settings. Once we have changed our computer's network settings, we can change the IP values of the switch.

To change the IP settings of the Switch, you must open the internet browser at the top of the computer screen and enter the factory default IP address of the switch -Click ok. The switch will have a "home page" that will allow you to navigate through its settings. At this time you can enter the switch's name, location, IP address, Subnet mask and the Ethernet Interface. Ethernet Interface refers to the switches ability to send and receive data in either half duplex or full duplex. For example, in Half Duplex information can move in only one direction at a time. In Full Duplex, information can be sent and received at the same time in both directions between switches.

Changing Computer Network Settings:

My Network Places- r click
Properties-1 click

Local area connection- r click
Properties- 1 click
Scroll down to “internet protocol”
Properties- 1 click

Enter the IP address and the Sub Net mask address should appear

EX:

IP Add: 192.168.0.52
Sub Net: 255.255.255.0

Click OK and you should be connected

3 TYPES OF VIDEO SYSTEMS

All video systems consist of a camera, a bi-directional receiver or encoder at the field cabinet and a bi-directional receiver or decoder back at the management center.

Fiber Optic Video System- Camera images and RS 232/422 commands are transmitted over a fiber optic network via light signals.



T-1 Line Video System- Camera images and RS 232/422 commands are transmitted on a T-1 line using a line conditioner. The line conditioner changes Ethernet video and command packets into twisted pair T-1 packets for transmission over a T-1 data line.

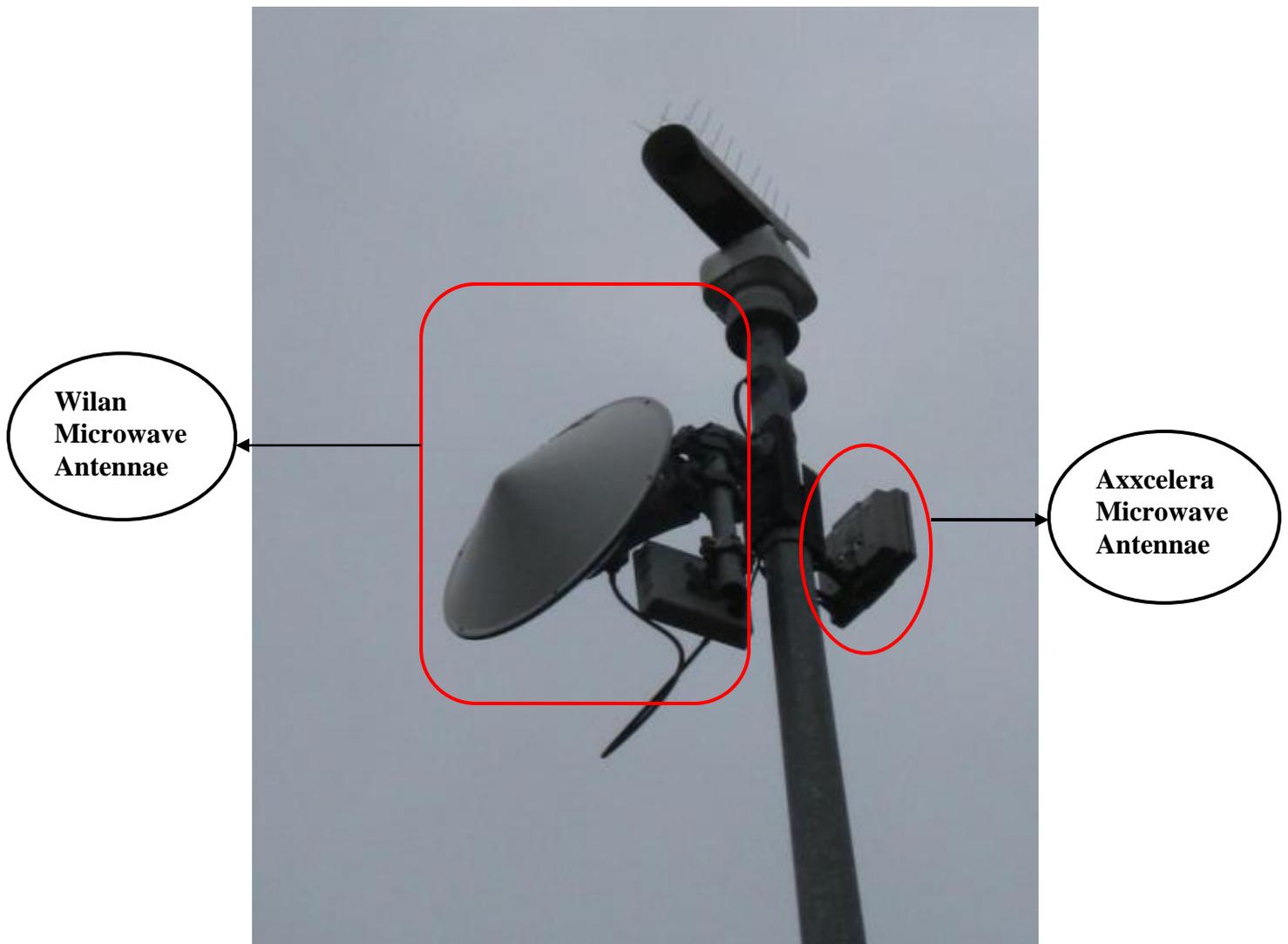


Microwave Video System- Camera images and commands are transmitted using microwaves. Composite video and RS 232/422 commands are first encoded into Ethernet, and later into radio frequencies. The frequencies are then transmitted via microwave antennae.



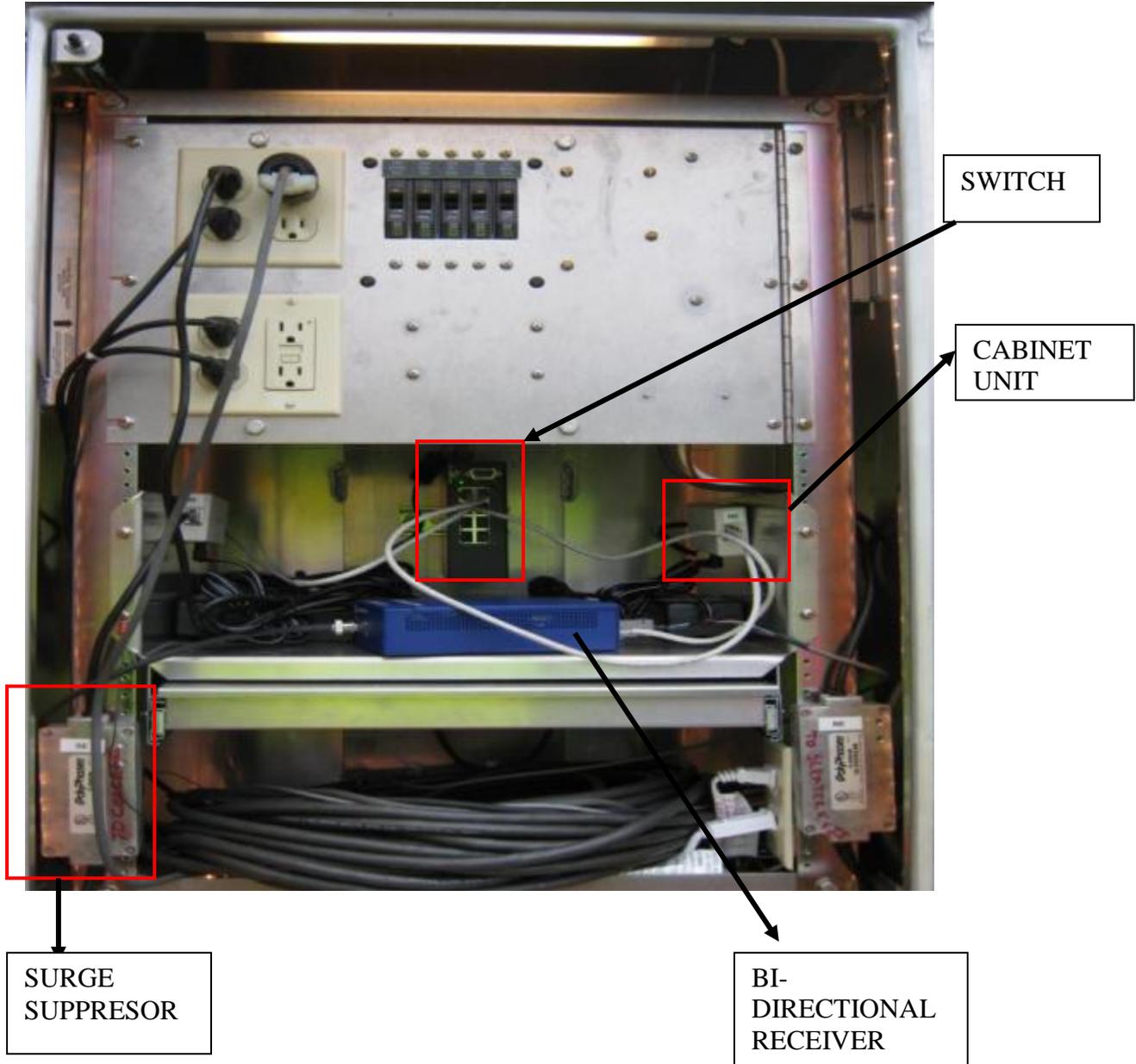
Three types of microwave antennae's are currently being used in Olympic Region: Wilan, Axxcelera and Solectek. Each antenna has a corresponding cabinet unit. This unit supplies 48 or 28 vdc to the radio antenna and also contains an Ethernet port for programming. 120vac comes into the cabinet unit and is then changed to 48 or 28vdc. When two antennas are used to send data in different directions, two cabinet units may be connected to a switch. The bi-directional receiver may also connect to the switch using Ethernet. In some installations, only a crossover Ethernet cable is used to connect devices. From the switch the Ethernet goes through the cabinet unit, to the lightning surge suppressor and up to the radio portion of the antennae. At this time the Ethernet is then changed into Radio Frequency Energy at 5.8Ghz

EXAMPLE MICROWAVE ANTENNAE UNITS



EXAMPLE CABINET UNITS

SOLECTEK CABINET UNIT



**AXXCELERA
CABINET UNIT**

Surge Suppressor

**Axxcelera
Cabinet
Unit**



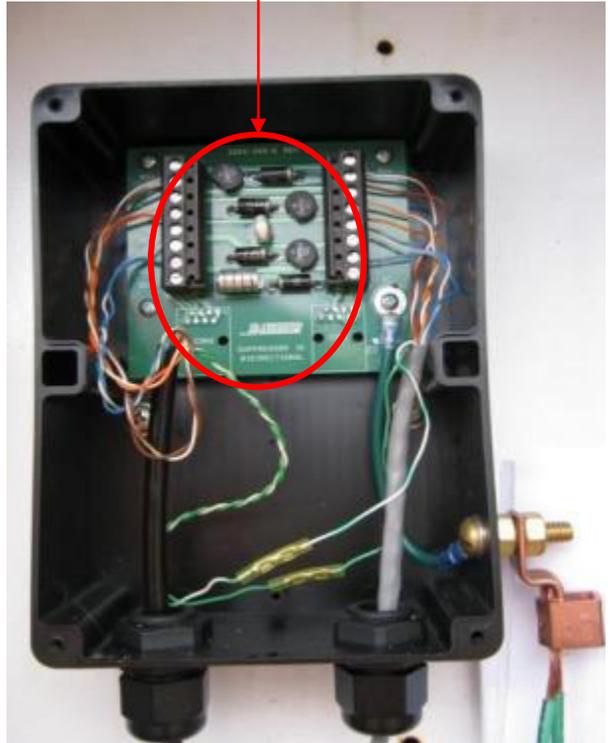
REPEATER SITE

Microwaves need to have line of site between them in order for the signal to be sent properly. A repeater site is used when obstacles such as hills and trees are present. A repeater allows the signal to be “bent” around the obstacle to keep the signal freely moving.



LIGHTNING SURGE SUPPRESSION
ALPU-TSU

Protective
Components



TROUBLESHOOTING

Possible Problems:

The camera has no video

Incorrect camera I.D.

No Pan/Tilt

No power to camera

F/O receiver locked up

Fuses are MDL .5, .75, 1.5

Solutions:

The camera shut itself off as a safety measure because of a power surge. Turn the camera back on by clicking on the latch command 'camera power'.

The coax cable connector might be broken. Attach a new connector.

Click the box labeled 'camera I.D.' (right side of your screen) Look at the labels in the I.D. text boxes. Make sure it corresponds to the correct label in SIMMS and click 'enable all'. Then click 'close'. Check on your monitor that the correct I.D. is showing up on the screen.

Check/replace the fuse

Check/replace the fuse

For MPC-D, remove the white cover plate. For rack mounted MPC-D, The fuses are inside the unit on the top, so you must remove the unit from the rack. Then, remove the front and top covers to replace the fuses.

Re-set power to receiver/transmitter or loosen the card screws and reset.

Possible Problems:**Solutions:****Blue Screen**

No input signal coming to the color monitor. Dead camera, no power to camera, broken or separated coax or video cable, center pin of coax is pulled back or cut cable

Black Screen

Input signal of some sort is coming to the color monitor. fully closed iris, corrosion on the coax or video fittings or connections, indoor rated cable in an outdoor environment is failing, or possibly the transmitting device (although a failed transmitter will often give you "snow").

Black Screen with a Camera ID

The ID generator is working but the video isn't, and the causes are the same as above.

White Screen or Washed Out

Caused by the Iris being wide open. If it's in manual mode check the setting and make sure it is not wide open; and if it is in auto mode check to see if it will close manually and then put back to auto and see if it washes out again.

Fuzzy Focus

A common indication of focus being out is that the camera is in focus in wide or narrow field of view but not both, or it is out of focus throughout the entire range. Pick a point in the far distance and zoom in on it. Then manually focus the image until clear. Then zoom back out.

Camera Movement Impaired or Oscillating

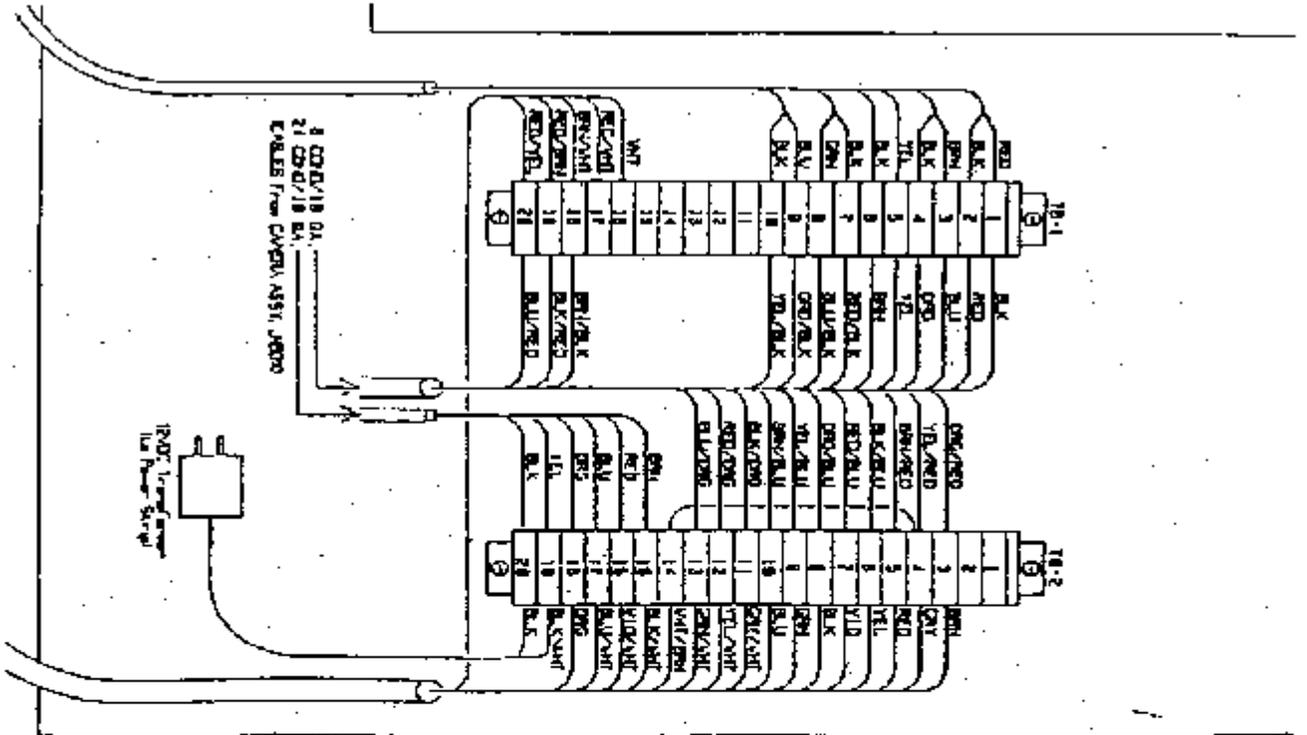
If it has a pan/tilt unit, the limit switch could be bad or it could be getting bad positioning info from the pan/tilt controller. Oscillation could be caused by the mounting structure or loose mounts.

PREVENTATIVE MAINTENANCE

- 1. Notify TMC and Verify the Equipment's Status**
- 2. CAMERA CABINET**
 - A. Check all wiring, cables and terminations**
 - B. Check modem, server, timer, UPS, transceiver and microwave equipment**
 - C. Check cabinet paint, seals, locks, hinges, vents, fans, lights, thermostat, heater, etc.**
 - D. Check input voltage**
 - E. Clean cabinet and replace filter(s)**
- 3. JUNCTION BOXES**
 - A. Check all junction boxes for proper elevation, remove debris and check for conduit bonding.**
 - B. Vegetation control**
 - C. Paint**
- 4. CAMERA HOUSING**
 - A. Clean camera lens, housing, pan/tilt assembly**
 - B. Inspect cables, connectors and mounts**
 - C. Check humidity indicator card**
 - D. Inspect nitrogen pressure**
 - 1. Pressure should be 5 PSI. Charge if necessary**
 - E. Inspect pan/tilt gasket, drive chains/ belts for wear and tension.**

Wiring Schematics:

Figure A



I-54178 3rd

FUNCTION ASSIGNMENTS

TB-1		TB-2	
1- PAN LEFT	1- EX1 SYNC (NOT USED)	1- EX1 SYNC (NOT USED)	1- EX1 SYNC (NOT USED)
2- PAN RIGHT	2- SYNC (NOT USED)	2- SYNC (NOT USED)	2- SYNC (NOT USED)
3- TILT UP	3- AUTO/MANI WRT. SW.	3- AUTO/MANI WRT. SW.	3- AUTO/MANI WRT. SW.
4- TILT DOWN	4- GND	4- GND	4- GND
5- P/TI CONTROL	5- -5VDC	5- -5VDC	5- -5VDC
6- PAN PRESET	6- LENS ZOOM	6- LENS ZOOM	6- LENS ZOOM
7- TILT PRESET	7- LENS FOCUS	7- LENS FOCUS	7- LENS FOCUS
8- PRESET -5V	8- LENS CONTROL	8- LENS CONTROL	8- LENS CONTROL
9- PRESET (GND)	9- LENS IN/LS	9- LENS IN/LS	9- LENS IN/LS
10- -5VDC	10- POS. REF. RETURN	10- POS. REF. RETURN	10- POS. REF. RETURN
11- -5VDC	11- POS. REF.	11- POS. REF.	11- POS. REF.
12- -5VDC	12- ZOOM POS.	12- ZOOM POS.	12- ZOOM POS.
13- -5VDC	13- FOCUS POS	13- FOCUS POS	13- FOCUS POS
14- -5VDC	14- GND	14- GND	14- GND
15- -5VDC	15- AUTO/MANI TILT	15- AUTO/MANI TILT	15- AUTO/MANI TILT
16- HOUSING MTR. (NOT USED)	16- PEAK AVE. MANI WRT. SW.	16- PEAK AVE. MANI WRT. SW.	16- PEAK AVE. MANI WRT. SW.
17- HOUSING MTR. (NOT USED)	17- 11.0VDC (24V. 100V)	17- 11.0VDC (24V. 100V)	17- 11.0VDC (24V. 100V)
18- HOUSING 115 VAC HI	18- 10 OHM. DEL. 100V	18- 10 OHM. DEL. 100V	18- 10 OHM. DEL. 100V
19- HOUSING 115 VAC LO	19- F.O. 12VDC	19- F.O. 12VDC	19- F.O. 12VDC
20- HOUSING AC GND	20- F.O. GND	20- F.O. GND	20- F.O. GND

← 18" Flush Mounting Plate

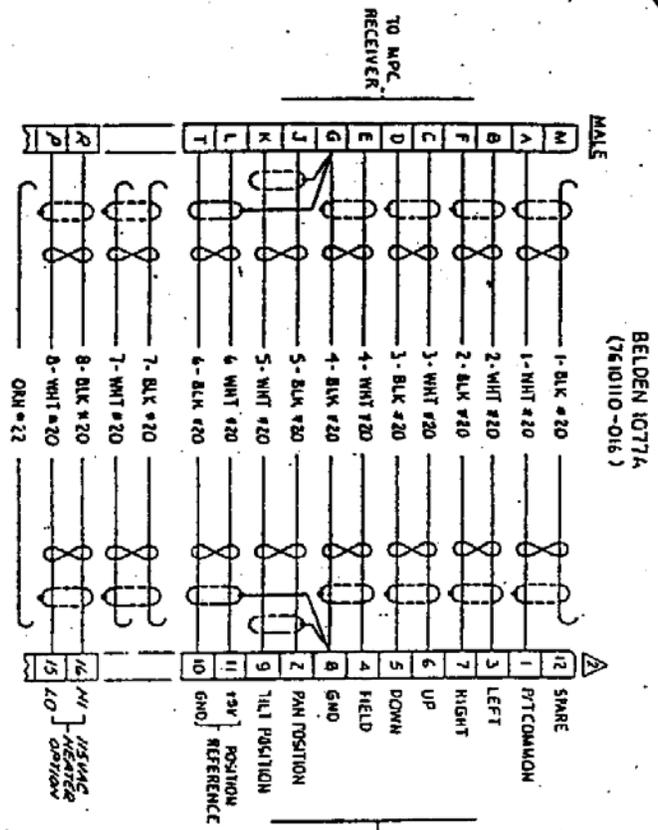
CAMERA ASSEMBLY CONTROL RECE
WIRING DIAGRAM

SCALE: NONE
DATE: 01.00.01

DRAWN 2
REVISED

Figure C

LEFT TR #1



Item No.	Description	Part No.	Quantity
D3	RED WAX: BELDEN 1077A WAS 9874 & 1	9874	20
B2	PN TILTING-OR WAS 7610110-016 ENGLISH	7610110-016	1
F	NOTE: 1. BUSHING P/N WAS 4441001. P/N 4441001 WAS 4441001. 2. COM-CAUSE THE P/N WAS 65538-1. 3. ABSD CAUSE P/N'S FOR AMP YAKTS. 4. ABSD WETS. CLK 6791	4441001	1
G2	WAS 65538-1. ABSD CAUSE P/N'S FOR AMP YAKTS. 4. ABSD WETS. CLK 6791	65538-1	1

CA238	CONNECTOR WALE	CLAMP OR BUSHING	CONNECTION	BOOT	CONNECTOR KEYING PLUG LOCATION
-A	MS 3106E-20-29P (0310077-SH)	SUPPLIED WITH CONNECTOR	MALE	AMP P/N 51011-1 (1310307-101)	TO BE DETERMINED
-8	MS 3108E-24-29P (0310045-S8S) (RIGHT ANGLE)	SUPPLIED WITH CONNECTOR	FEMALE	AMP P/N 51011-1 (1310307-101)	TO BE DETERMINED

USE AMP BOOT IN PLACE OF AMP CLAMP 206070-1.
 SET TABLE CA238 FOR KEY POSITION.

THE FOLLOWING PARTS ARE SUPPLIED WITH P/N UNITS:
 CONNECTOR - AMP P/N 206037-1 (1310307-003)
 BUSHING - AMP P/N 206037-1 (1310307-101)
 CLAMP - AMP P/N 51011-1 (1310307-101)
 AMP P/N 51011-1 (1310307-101)
 AMP P/N 51011-1 (1310307-101)
 AMP P/N 51011-1 (1310307-101)

NOTES: UNLESS OTHERWISE SPECIFIED

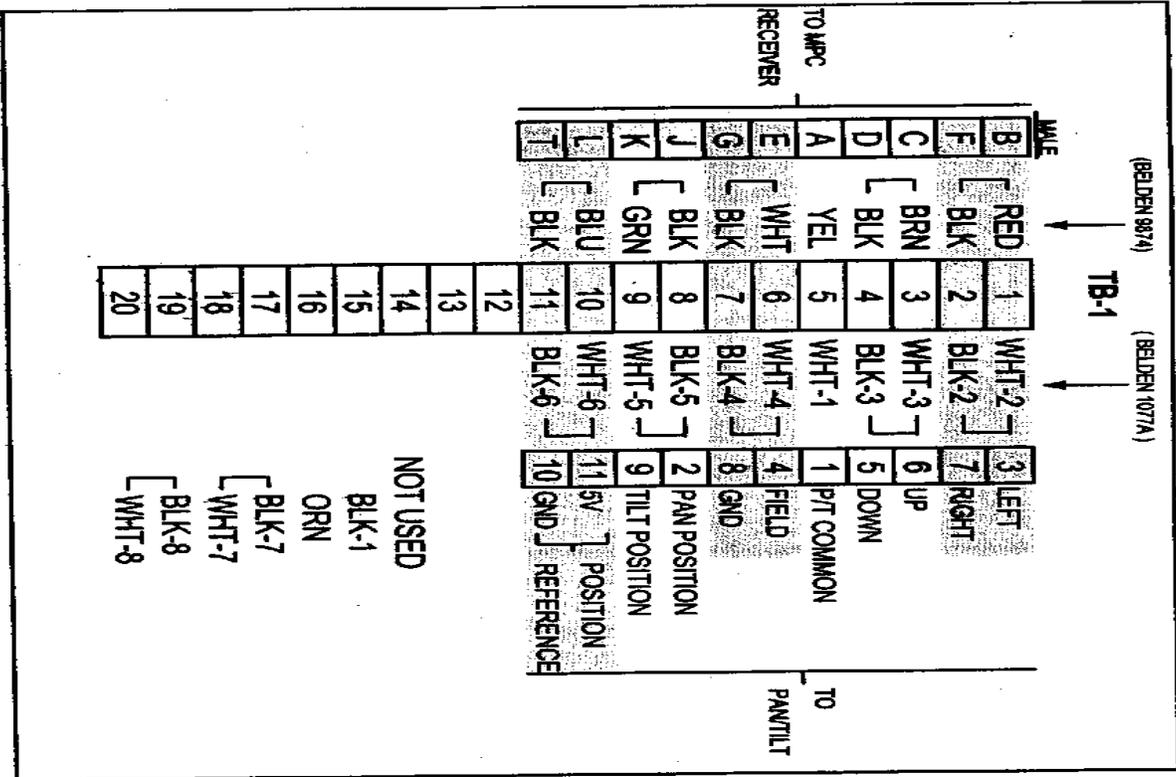
Part No.	Description	Quantity
CA238	Wiring Diagram	1
CA238	Wiring Diagram	1
CA238	Wiring Diagram	1

THIS CABLE CAN BE USED WITH THE FOLLOWING PAN/TILTS:
 PT 550PP
 PT 570PP
 PT 520PP
 PT 1250DPP
 PT 1250DPP

COHU ELECTRONICS DIVISION
 CABLE ASSEMBLY.
 MPC RECEIVER TO PELCO PAN/TILT
 CA238
 7411238
 05157

Figure D

COHU CCTV FUNCTION ASSIGNMENTS



TB-2 (COHU AC/ZE CAMERA CABLE)

Terminal	Assignment	Function
1	BLU/WHT	16 CHAR GEN. INPUT (RS-422)
2	ORG	16 CHAR GEN. INPUT (RS-422)
3	BLU	LENS POSITION REF. (GRD.)
4	GRY/WHT	LENS POSITION REF. (+5V.)
5	YEL/WHT	ZOOM POSITION
6	GRN/WHT	FOCUS POSITION
7	WHT/BRN	GROUND
8	BLK/WHT	AUTOMANUAL IRIS
9	W/O/WHT	MANUAL WHITE BALANCE
10	BRN	AUTOMAN. WHITE BALANCE
11	YEL	LENS ZOOM
12	W/O	LENS FOCUS
13	GRN	LENS IRIS
14	BLK	LENS COMMON
15	(SHIELD)	SHIELDS
16	BRN/WHT	15VAC HIGH
17	RED/BRN	15VAC LOW
18	RED/YEL	AC GROUND
19	WHT	AC HEATER
20	RED/WHT	AC HEATER

Handwritten notes: 160V, TB-1

Pan/Tilt = 120 volts Zoom/Focus = 3-8 volts

Figure E

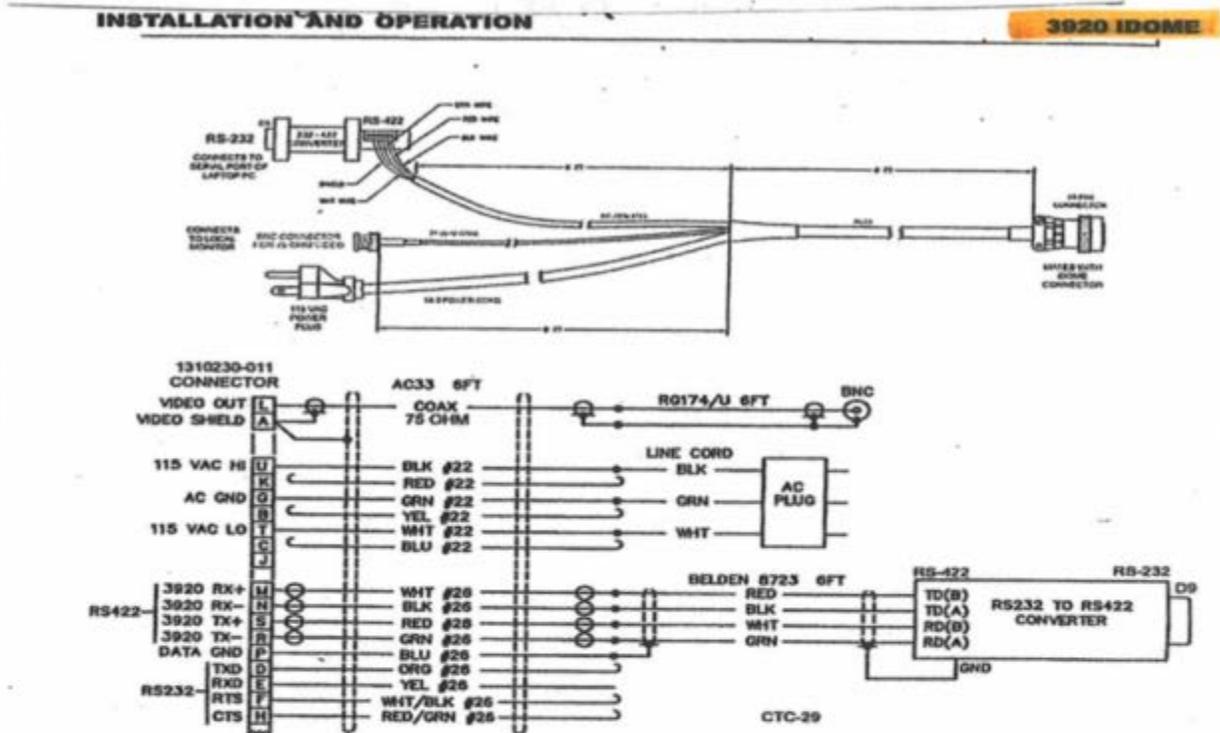


Figure 5. Type CTC-29 Cable , Test/Setup, Wiring Diagram



This converter changes the RS-232 output of a PC to RS-422 for communications with an IDome during field setup and testing.

A local PC with Win MPC software typically is used in this application.

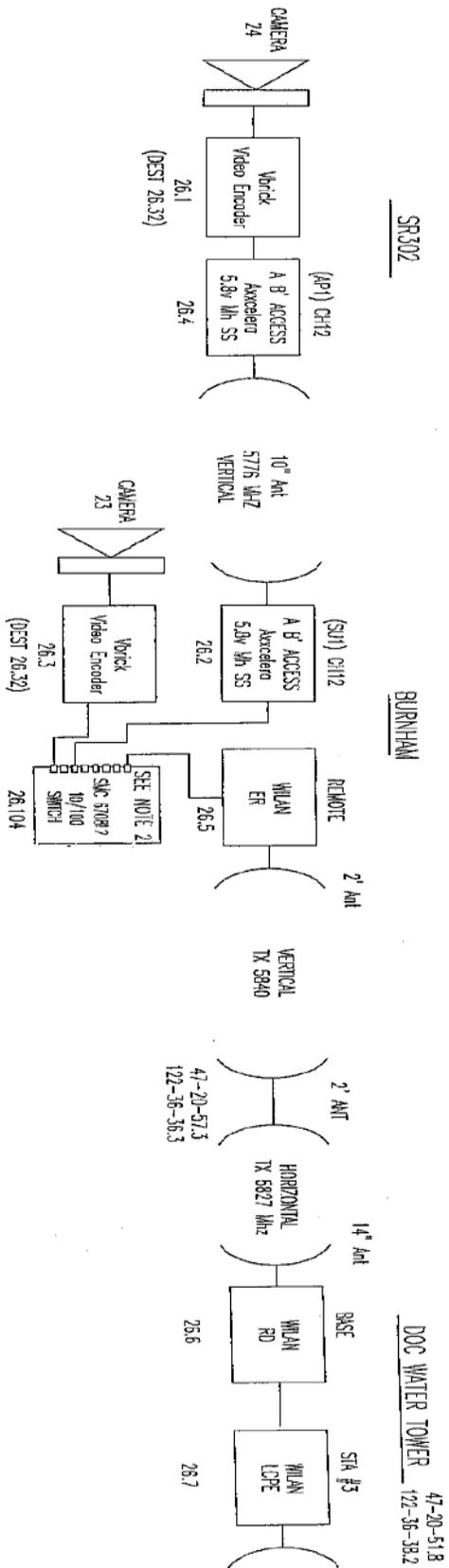
If this converter is plugged into the RS-232 output from an F/O converter, 12 V dc operating power will likely have to be applied to the 12 V dc terminal lugs. These F/O to RS-232 converters typically do not have sufficient current on the handshake lines to power the 232/422 converter. This application of the 232/422 converter would typically occur as part of a fixed installation inside an equipment cabinet located near an IDome. The 232/422 converter would be part of a type CA-295C cable.

Figure 6. Typical RS-232 to RS-422 Converter

RDA = Green RDB = Red TDB = White TDA = Black Ground = Blue

CCTV

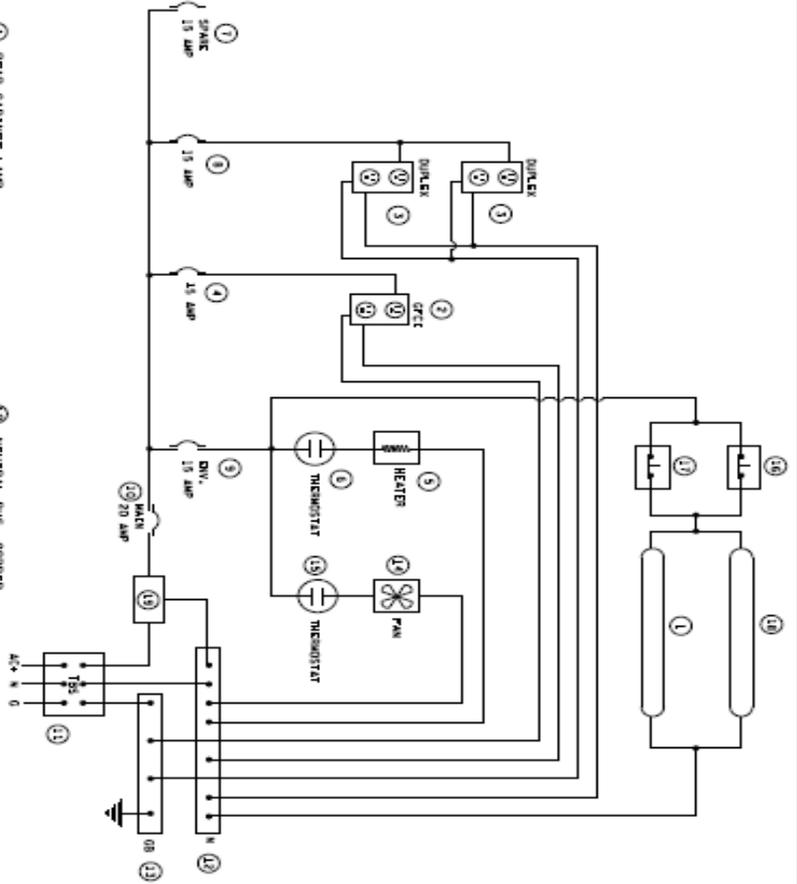
Microwave One Line Diagram



MASTER DETAIL REVISED 01/12/07

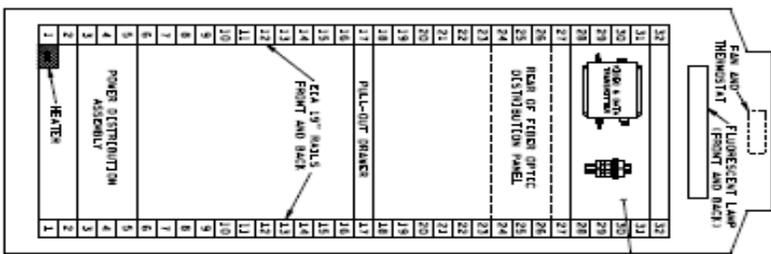
- ① REAR CABINET LAMP
- ② GFCI OUTLET OUTLET RECEPTACLE
- ③ EIA OUTLET RECEPTACLE
- ④ 15 AMP BREAKER FOR GFCI OUTLET
- ⑤ 100 WATT STRIP HEATER
- ⑥ THERMOSTAT, 50°F CLOSURE
- ⑦ 15 AMP SPARE BREAKER
- ⑧ 15 AMP RECEPTACLE BREAKER
- ⑨ 20 AMP MAIN BREAKER
- ⑩ POWER TERMINAL BLOCK

- ⑪ NEUTRAL BUS, COPPER
- ⑫ GROUND BUS, COPPER
- ⑬ COOLING FAN
- ⑭ THERMOSTAT, 70°F CLOSURE
- ⑮ FRONT DOOR SWITCH (10 A), N.C.
- ⑯ REAR DOOR SWITCH (10 A), N.C.
- ⑰ FRONT CABINET LAMP
- ⑱ SURGE SUPPRESSOR AND FILTER.

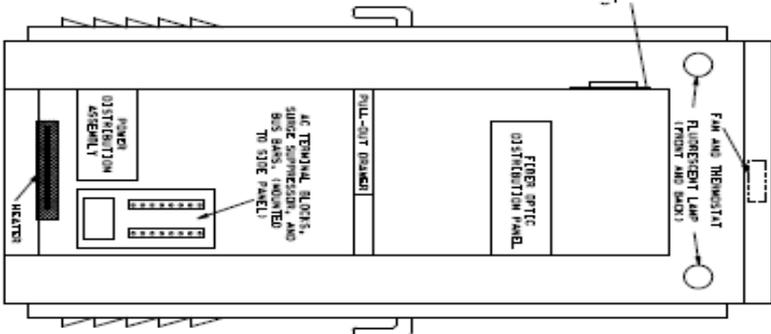


CAMERA CABINET WIRING DIAGRAM

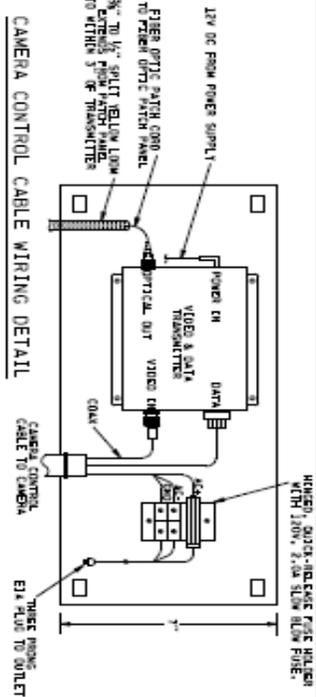
NOT TO SCALE



CAMERA CABINET WIRING DETAIL - FRONT VIEW



CAMERA CABINET WIRING DETAIL - SIDE VIEW



CAMERA CONTROL CABLE WIRING DETAIL

FILE NAME	SMALLER/CONTINGUOUS/REMOVED LINE/DETAIL/REVISED	PROJECT NUMBER
DATE	10/12/07	
DESIGNED BY	WSP	
CHECKED BY	WSP	
APPROVED BY	WSP	
REVISION		

Washington State Department of Transportation

FIG. 2

Citations

How Stuff Works.com/camcorder. 10-28-10.

Indigo Vision 8000 Hardware Guide. IndigoVision Ltd. Pgs 7-13. March 23, 2005.